SHOCK ABSORBING BASEBALL BAT

AND

METHOD OF MANUFACTURING

CLAIM OF PRIORITY

This application is a continuation-in-part application and claims priority from and the benefit of U.S. Provisional Application No. 60/254944 titled "Shock Absorbing Baseball Bat and Method of Manufacturing" filed December 12, 2000.

BACKGROUND OF THE INVENTION

1. *Field of the Invention*

In the case of baseball bats, and particularly aluminum bats, it is desirable to reduce the shock transmitted from the impact of the ball to the handle of the bat and to the hands of the batter. This invention generally relates to baseball bats having a shock resistant handle, a shock resisting grip for baseball bats, and a method of applying a shock resistant grip to baseball bats. In addition, the invention relates to imparting shock absorbing and vibration damping properties to other tubular or cylindrical articles. In addition, the invention relates to increasing the strength of elongated articles.

2. *Prior Art*

U.S. Patent No. 6,036,610 discloses a braided hybrid composite overlay laminated to the handle of a wooden bat to provide an enhanced gripping surface and to strengthen the bat.

U.S. Patent No. 3,129,003 discloses a baseball bat with a reinforced handle having a woven sleeve

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of glass fibers laminated to the bat handle.

None of the prior art describes a bat having a tubular braided composite overlay member which is designed to absorb and reduce shock and vibration.

SUMMARY OF THE INVENTION

The present invention provides a baseball bat which has a shock absorbing grip to absorb shock and dampen vibration and also provide an enhanced gripping surface. This invention utilizes a biaxially braided tubular overlay member which is formed from a plurality of carbon fibers and a plurality of aramid fibers. The tubular member or sleeve is applied over the end of the bat. A thermo-setting resin matrix material is applied to the tubular overlay and the handle of the bat such that the sleeve is substantially saturated. The sleeve is then compressed with a shrink wrap tape under pressure. The bat is then cured in an oven and the shrink wrap tape is removed from the bat.

The baseball bat made in accordance with this invention will absorb a significant amount of shock and vibration. The invention is applicable to wood and composite bats as well as aluminum bats. Further, the invention is also applicable to softball bats. Finally, it should be noted that the invention is applicable to many other articles where shock absorption and vibration damping are desired.

In addition to the shock absorbing and vibration damping properties, the principles of this invention may be applied in a number of different contexts to impart increased strength to a wide variety of different articles. Qualitative evaluation has shown that articles prepared in accordance with the

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principles of this invention have a strength substantially greater than the strength of the same article without any laminated reinforcing material and greater that the strength of the same article prepared in accordance with the invention disclosed in U.S. Patent No. 6,036,610. Examples of such articles include the handles of tools and other devices subject to impact such as hammers, axes, shovels, sledge hammers, picks, mattocks, hoes, shears, and cutters; athletic equipment subject to impact such as baseball bats, softball bats, cricket bats, hockey sticks, field hockey sticks, ice hockey sticks, roller hockey sticks, lacrosse sticks, rackets, golf club shafts and exercise equipment; frames such as the frames of bicycles, mountain bikes, ultra lights, hang gliders and exercise equipment; and other objects such as boat masts, oars, paddles, mop handles, broom handles, fishing equipment, posts and poles.

It should be understood that the present invention may be applied to virtually any elongated object and that such objects may have a wide variety of different cross sectional shapes such as tubular, cylindrical, ovular, triangular, quadrilateral, hexagonal, octagonal, etc.

BRIEF DESCRIPTION OF THE DRAWINGS

Figure 1 is a plan view of a baseball bat having an overlay member laminated to the grip in accordance with the principles of this invention.

Figure 2 is an exploded plan view of a portion of a tubular composite braided overlay member in accordance with the principles of this invention.

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Figure 3 is a graph illustrating the shock damping characteristics of an aluminum baseball bat with a conventional leather grip.

Figure 4 is a graph illustrating the shock damping characteristics of an aluminum baseball bat with a grip made in accordance with this invention.

DETAILED DESCRIPTION OF PREFERRED EMBODIMENTS

The following description is of the best currently contemplated mode for carrying out the invention. This description is made for the purpose of illustrating the general principles of the invention and should not be taken in a limiting sense.

In accordance with the present invention, there is shown in Figure 1 a baseball bat generally designated as 10 having a barrel or hitting portion 11, a grip or handle portion 12, and a knob 13 at the free end of the grip. A braided tubular hybrid composite overlay member 14 is laminated to the handle 12. The member 14 is a biaxially braided or woven tubular shape member made from a plurality of carbon fibers 16 and aramid fibers 17 which are braided together. Preferably the overlay member 14 is braided with 50% of the fibers being carbon and 50% of the fibers being aramid, or any optimal combination thereof. The overlay member 14 should be no longer than 18 inches which is the maximum span allowable by major league baseball to enhance the grip surface of the handle.

The text of U.S. Patent No. 6,036,601 is incorporated by reference herein.

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It has been determined and validated that significant shock and vibration damping is obtained by the use of this invention. To obtain these results, a sleeve of graphite and aramid material is slipped over the knob 13 of a baseball bat 10. For aluminum bats, the bottom end of the sleeve is positioned to be abutting against the knob 13 of the bat for maximum dampening effect. For wood bats, where the knob slopes into the handle 12, it is required that a space be left between the end of the sleeve and the knob. Thermosetting resin matrix material, preferably epoxy, is inserted into the interior of the sleeve at the top. The sleeve is stretched and the epoxy is worked from the top of the sleeve to the bottom of the sleeve, and is worked from the interior of the sleeve to the exterior. The working is accomplished by kneading while extending the sleeve so that the sleeve is substantially saturated. Excess epoxy is wiped off the sleeve until the sleeve appears dry. The bat is then wrapped with a cellophane shrink wrap from the knob to a distance of 23 inches toward the barrel end of the bat. The cellophane shrink tape compresses the epoxy saturated sleeve to the bat handle under at least approximately 150 lbs. per square inch pressure. The bat is placed in an oven at 200 degrees F for 30 minutes. After curing, the bat is removed from the oven and the cellophane shrink tape is removed. The foregoing procedure eliminates almost 100% of any air bubbles or voids in the resin matrix and bonds the sleeve to the bat handle completely so that it becomes an integral part of the handle. The resultant bat reduces shock and vibrations by at least 60% when compared to a bat without any grip.

Two aluminum bats were tested to determine the amount of vibration damping. One bat was gripped with the shock absorbing grip of this invention. The second bat, after measuring its weight, was gripped with a standard leather grip. The properties of these bats are shown in Table 1 below:

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Table 1 – Bat Dimensions

Grip	Shock Resistant Bat	Conventional Aluminum Bat	Aluminum Bat with Leather Grip
Weight (oz)	30.48	28.47	29.22
Length (in)	33.94	33.88	33.88
CG (in-from barrel end)	12.69	11.88	12.25

Accelerometers were mounted on the barrel (0.5 in. from the end), the midpoint on the bat and on the handle's grip (3.0 in. from the end). The accelerometers were labeled channels 1, 2 and 3, respectively. The bat was suspended by two cords located 6 inches from each end. A major league baseball was used to apply an impact near the end of the barrel. Vibration data were measured by the accelerometers and processed using a data-acquisition/spectral-analysis system. The data were recorded at sampling rates of 4096 and 10240 Hz to allow for identification of the first three vibrational modes of the bat. Two to three impacts were recorded for each of the three grip configurations. For each test, the shock pulse was plotted along with its frequency spectral content for a time frame just after impact.

Figures 3 and 4 show the vibration of the handle portion of the bat (channel 3). The results show that the shock absorbing grip of this invention provides significant damping to the first two bending modes and the hoop mode of the aluminum bat. The damping effect of the leather grip was minimal.

During the first ¼ second following impact, the handle-vibration level in the leather grip bat was reduced by approximately 25% in comparison to without any grip. During the same time period,

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the shock resistant grip of this invention reduced the vibration level by 60%.

To validate the results qualitatively, the bats in accordance with this invention were compared to conventional bats using field testing in the batting cage. The damping effect of the subject grip was obvious through both reduced-sound levels and by personal feel in the hands.

In summary, the testing showed that the subject grip on an aluminum bat significantly decreases the amount of shock and vibration transmitted to the batter's hands. The subject grip can effectively eliminate the sting of an aluminum bat.

It should be noted that the principles of the present invention may be used to impart shock absorbing and vibration damping properties to a wide variety of different articles. For example, the handle of a hammer may be treated in a manner similar to that described above to impart the handle with shock absorbing and vibrational damping properties. The principles of the invention may be applied in any context where it is desired to impart an article with shock absorbing or vibration damping properties.

In addition, to the shock absorbing and vibration damping properties, the use of this invention can impart increased strength to a wide variety of articles. Qualitative evaluation has shown that articles prepared in accordance with the principles of this invention have a strength substantially greater than the strength of the same article without any laminated reinforcing material and greater that the strength of the same article prepared in accordance with the invention disclosed in

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U.S. Patent No. 6,036,610. Examples of such articles include the handles of tools and other devices subject to impact such as hammers, axes, shovels, sledge hammers, picks, mattocks, hoes, shears, and cutters; athletic equipment subject to impact such as baseball bats, softball bats, cricket bats, hockey sticks, field hockey sticks, ice hockey sticks, roller hockey sticks, lacrosse sticks, rackets, golf club shafts and exercise equipment; frames such as the frames of bicycles, mountain bikes, ultra lights, hang gliders and exercise equipment; and other objects such as boat masts, oars, paddles, mop handles, broom handles, fishing equipment, posts and poles.

It should be understood that the present invention may be applied to virtually any elongated object and that such objects may have a wide variety of different cross sectional shapes such as tubular, cylindrical, ovular, triangular, quadrilateral, hexagonal, octagonal, etc.

Although the invention is described herein with reference to a specific embodiment, many modifications and variations therein will readily occur to those skilled in the art. Accordingly, all such variations and modifications are included within the intended scope of the invention.

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